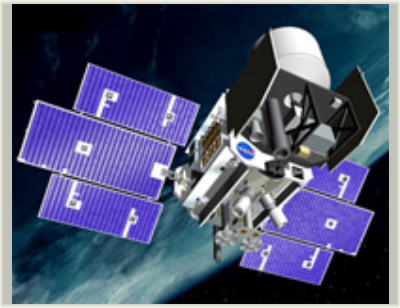
High Power Ga2O3-Based Schottky Diode, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

This SBIR Program will develop a new generation of radiation hard high-power high-voltage Ga2O3-based Schottky diode, which is suitable for applications in the space environment. Wide bandgap (WBG) semiconductors have the potential to yield much more efficient power electronics than silicon, because their larger bandgaps allow them to withstand higher electric fields with less material, which also leads to lower system size and weight. While SiC and GaN are the two most technologically advanced WBG semiconductors, Ga2O3 is very promising and a new alternative. It has a larger bandgap (~4.8 eV) than either SiC (3.3 eV) and GaN (3.4 eV). Its large bandgap allows it to handle large electric fields, which in turn gives it a 4-10 times larger figure-of-merit than SiC and GaN for power devices. Ga2O3 has already been demonstrated in a variety of discrete electronic and optoelectronic devices, such as metal-semiconductor and metal-oxide-semiconductor field-effect transistors, and UV sensors. Despite its potential, few companies have explored the Ga2O3 for power electronics in the US. The Schottky diode proposed will be used as a rectifier in the power applications because of its low forward voltage drop leading to lower levels of power loss compared to ordinary PN junction diodes. The Schottky diode performance can far exceed that of other diodes in many areas due to its low turn on voltage, low junction capacitance and fast recovery time. The Phase I project will also include modeling of material and device design, and production costs to NASA for commercial implementation. During Phase II, we will build complete high power Ga2O3-based Schottky diode prototypes and test them under heavy ion and total dose radiation. We will demonstrate scale-up of the processing technology to the high power Ga2O3-based Schottky diode. We will also define the pathway to Phase III high volume production.



High Power Ga2O3-based Schottky Diode, Phase I Briefing Chart Image

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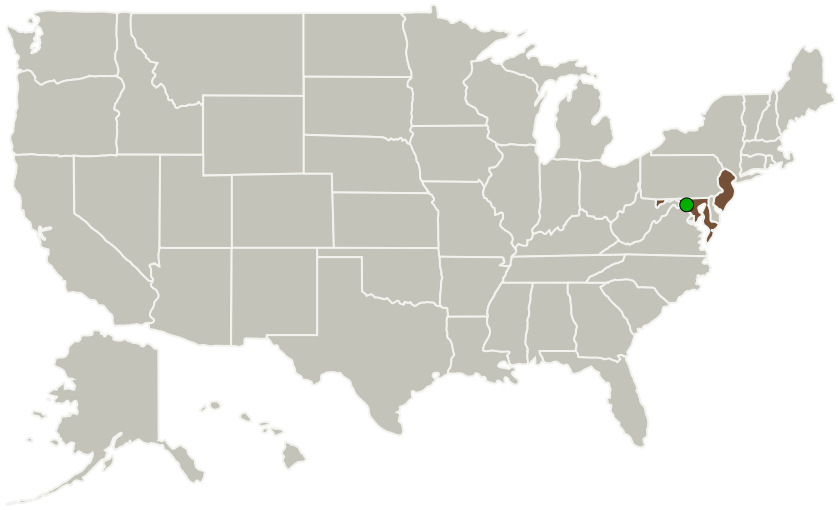
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Structured Materials Industries, Inc.	Lead Organization	Industry	Piscataway, New Jersey
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Maryland	New Jersey

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Structured Materials Industries, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

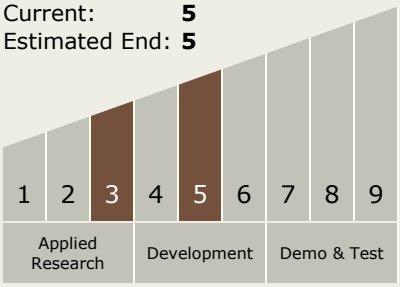
Carlos Torrez

Principal Investigator:

Serdal Okur

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



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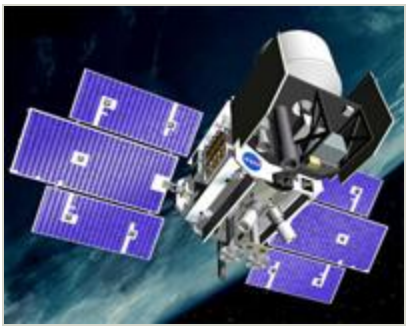
Images



Briefing Chart Image
High Power Ga2O3-based Schottky Diode, Phase I Briefing Chart Image
(https://techport.nasa.gov/image/127951)

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.3 Power Management and Distribution
    - TX03.3.4 Advanced Electronic Parts

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System